

**STATUS OF THE PIPING PLOVER IN MASSACHUSETTS:**

**1998 SUMMARY REPORT**

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Observers reported a total of 495 breeding pairs of Piping Plovers (Charadrius melodus) at 98 sites in Massachusetts in 1998 (Table 1). An additional 43 sites were monitored one or more times during May or June, but no breeding pairs were detected. Breeding pairs are defined as pairs observed with either a nest or unfledged chicks or that exhibit site tenacity and evidence of pair bonding and territoriality for at least two weeks. Overall observer effort in 1998, measured as number of sites surveyed and intensity of census effort at each site, was roughly comparable to previous efforts conducted annually since 1986.

During the 1998 breeding season, we suspect that at least 18 pairs moved to new territories on the same beach and re-nested or nested at more than one site. These included pairs that departed territories before the end of the first week in June and pairs that established territories and nested after mid-June. These pairs were included in counts for all beaches where they occurred, but were tallied only once in regional and state totals for numbers of pairs and numbers of pairs for which fledging data were reported (Table 1).

The 1998 total of 495 pairs is the highest count of Piping Plovers recorded in Massachusetts since comprehensive statewide surveys began in 1986, and is an increase of 12 pairs (2.5%) over the 1997 count of 483 pairs (Table 2). Numbers of pairs increased in 4 regions of the state and declined in 4 (Table 3).

In addition to estimating total pairs present during the breeding season, cooperators also censused pairs at all occupied sites and 43 historic or potential sites during the standardized 1998 Atlantic Coast "index count" from 30 May to 7 June. The objective of the index count is to minimize double-counting of pairs that move between or within sites, thereby providing an index to population trends that may be more precise than the total count. The 1998 index count was 475 pairs (Table 1), 96% of the total count of 495 pairs and a 3.9% increase over the 1997 index count of 457 pairs.

Sites with the largest numbers of breeding pairs in the state in 1998 were South Beach-Chatham (40), Crane Beach (35), Sandy Neck (30), and South Monomoy Island (26). A total of 16 sites reported  $\geq 10$  pairs, and collectively they accounted for 59% of all pairs.

Overall mean productivity for Massachusetts in 1998 was 1.50 chicks fledged per pair based on data from 471 of 495 pairs (95%) at 93 of 98 (95%) nesting beaches (Table 2). A chick was considered fledged if it survived  $\geq 25$  days or was observed in

flight, whichever occurred first. Only 3 regions of the state (Lower Cape, Elizabeth Islands, Martha's Vineyard) averaged < 1.5 chicks fledged/pair (Table 3).

Based on reports from cooperators statewide, observed nest success was 0.57 (348 of 613 nests hatched  $\geq 1$  egg). For 597 nests for which complete data were reported, observed hatching success was 0.56 (1,187 of 2,117 eggs hatched) and fledging success was 0.57 (676 of 1,187 chicks survived to fledge).

Abandonment was the most commonly identified cause of nest loss in 1998, followed by nest flooding and predation by unknown predators, crows, and foxes (Table 4). Wire predator exclosures were used to protect 376 of 613 nests (61%). Nearly 14% of nests in exclosures were abandoned (52 of 376 nests) compared to 12% of nests without exclosures (29 of 237). Causes of nest abandonment were reported as unknown in 52 of 81 instances (64%) (Table 5). The most commonly suspected causes of nest abandonment were severe inclement weather (17 nests) and harassment by predators (9 nests).

Observed nest success (percentage of nests that hatched  $\geq 1$  egg) was 78% for nests protected with exclosures compared to only 38% for nests without exclosures (Table 6). Similarly, 72% of eggs protected with exclosures hatched compared to only 38% of unprotected eggs (Table 7).

As usual, few causes of chick mortality were directly observed or could be confidently surmised. A number of chicks were believed lost as a result of storms or cold, wet weather. This included 9 chicks from 3 broods that disappeared from Norton Point Beach during 2 bouts of cold, wet weather June 13-17 and June 28-July 1, 8 chicks from 3 broods at Plymouth Beach lost during a June 30 storm, 1 chick lost from South Beach in Chatham during a June 13-14 storm, and 2 of 4 chicks on Lucy Vincent Beach that may have died as the result of heavy rain during the period June 11-17. Two chicks at Crane Beach were found dead after repeated attacks by adults from neighboring pairs. Tracks outside exclosures suggested that a cat may have taken 2 newly hatched chicks at Scusset Beach and a raccoon may have taken 4 newly hatched chicks at Sandy Neck. At Kalmus Park, a 26 day-old chick was killed and partly eaten by a gull. At Dead Neck-Sampson's Island, a malformed chick with an incompletely developed body and shriveled wing died approximately 3 days after hatching. At Black Point Pond, 13 chicks from 4 broods disappeared within 2 days of hatching; tracks near exclosures suggested predation by crows or Black-crowned Night Herons. Finally, single chicks were found dead at the nest at Crane Beach and Sandy Neck. The dead chick at Crane Beach had hatched from a nest that had been abandoned by the adults several days earlier. The dead chick at Sandy Neck may have been left behind at the nest by its parents and siblings.

As always, we extend our sincere thanks to the many biologists, seasonal staff, beach managers, landowners, and volunteers that participated in conservation efforts on behalf of Piping Plovers and other coastal waterbirds in Massachusetts in 1998.

Table 1. Abundance, distribution, and productivity of Piping Plovers in Massachusetts, 1998.

Location	Number of pairs		No. chicks fledged <sup>c</sup>	No. pairs for which fledge data reported	Source <sup>d</sup>
	Index count <sup>a</sup>	Total count <sup>b</sup>			
NORTH SHORE					
34 Salisbury Beach, Salisbury	0	nd <sup>e</sup>	nd	nd	SM
35 Salisbury Bch. St. Res., Salisbury	0	nd	nd	nd	SM
36 Plum Island-North End, Newburyport/Newbury	1	1 <sup>f</sup>	0	1 <sup>f</sup>	DM, PD
37 Parker River NWR, Newbury/Rowley	16	16 <sup>g</sup>	11	15 <sup>g</sup>	DM, PD
38 Sandy Point State Res., Ipswich	2	4 <sup>g</sup>	5	4 <sup>g</sup>	DM, PD
39 Crane Beach, Ipswich	33	35 <sup>h</sup>	71	35 <sup>h</sup>	WC
40 Coffin's Beach, Gloucester	3	3	3	3	SH
41 Wingaersheek Beach, Gloucester	0	0	0	0	SH
42 Good Harbor Beach, Gloucester	nd	nd	nd	nd	-
SOUTH SHORE					
43 Third Cliff, Scituate	2 <sup>i</sup>	2 <sup>i</sup>	3	2 <sup>i</sup>	SH, HS
44 Fourth Cliff, Scituate	1 <sup>i</sup>	1 <sup>i</sup>	0	1 <sup>i</sup>	SH, HS
45 Duxbury Beach, Duxbury/Plymouth	14	14	18	14	JC, DC, TK, JL, SH
46 Plymouth Beach, Plymouth	13 <sup>j</sup>	13 <sup>j</sup>	19	13 <sup>j</sup>	DC, TK, RS, SH
47 Ellisville State Park, Plymouth	1	1	3	1	MZ
48 Sagamore Beach, Bourne and Sandwich	5	5	9	5	MZ
49 Scusset Beach State Res., Sandwich	1	1	2	1	MZ
UPPER CAPE					
50 Mashnee Dike	1	1	3	1	MZ
51 Black Beach/Sippewisset, W. Falmouth	1	1	nd	0	MB1, LG
52 Woodneck Beach, W. Falmouth	0	0	0	0	MB1, LG
53 Washburn Island, Falmouth	2	2	3	2	RV
54 South Cape Beach, Mashpee	5	5	4	5	RV
55 New Seabury, Mashpee	1	2 <sup>k</sup>	2	2 <sup>k</sup>	RV

Table 1. Continued.

Location	<u>Number of pairs</u>		No. chicks fledged	No. pairs for which fledge data reported	Source
	Index count	Total count			
Rock Landing/Maushop Village, Mashpee	0	nd	nd	nd	SM
Popponesset Spit, Mashpee	4	4	12	4	MB1, LG
Town Neck Beach, Sandwich	1	1	3	1	AG, LT
Springhill Beach, Sandwich	10	10	22	10	AG, LT
East Sandwich Beach, Sandwich	0	nd	nd	nd	SM
Scorton Creek, Sandwich	3	3	11	3	AG, LT
Scorton Shores, Sandwich	3	3	4	3	MC
Sandy Neck, Barnstable	30	30	34	27	CN, JT
Sampson's Is.-Dead Neck, Barnstable	4	4	14	4	MBa, AM, SH
Dowse's Beach, Osterville	nd	nd	nd	nd	-
Long Beach, Centerville	2	3 <sup>1</sup>	5	3 <sup>1</sup>	JL
Squaw Island, Hyannisport	3	3	11	3	JL
Kalmus Park Beach, Hyannis	3	3	4	3	JL, MF, MBa, LG
Gray's Beach, Yarmouth	4	4	2	1	BZ, KCr
Seagull Beach/Radio City, Yarmouth	4	4	13	4	SG, TE
Great Island, Yarmouth	6	6	7	6	SG, TE
West Dennis Beach, Dennis	1	1	4	1	KN, SO
Chapin Beach, Dennis	3	3	3	3	BZ, KCr
Mayflower Beach, Dennis	0	0	0	0	SO, KN
Howes St. Beach, Dennis	1	1	4	1	SO
Town Landings, Dennis	0	0	0	0	SO, KN
Corporation Beach, Dennis	0	0	0	0	SO, KN
Sesuit Beach, Dennis	0	0	0	0	SO, KN
Quivett Neck/Coles Pond, Dennis	1	1	0	0	SO
Wings Island, Brewster	nd	nd	nd	1	SO
Robbins Hill Beach, Brewster	0	0	0	nd	-
				0	SO

Table 1. Continued.

Location	<u>Number of pairs</u>		No. chicks fledged	No. pairs for which fledge data reported	Source
	Index count	Total count			
82 Town Beach, Brewster	0	0	0	0	SO
83 Ellis Launching Beach, Brewster	0	0	0	0	SO
84 Crosby Lane Beach, Brewster	0	nd	nd	nd	SM
85 Merkel Beach/Wychmere, Harwichport	1	1	1	1	LG, BZ, KCr
86 Red River Beach, Harwich	0	nd	nd	nd	SM
<b>LOWER CAPE</b>					
87 Forest Beach, Chatham	0	nd	nd	nd	SM
88 Cockle Cove/Ridgevale Beach, Chatham	0	nd	nd	nd	SM
89 Harding Beach, Chatham	1	1	2	1	LS
90 Harding Beach Point, Chatham	nd	nd	nd	nd	-
91 North Monomoy Island, Chatham	1	1	4	1	SKe, SKo
92 South Monomoy Island, Chatham	24	26	18	26	SKe, SKo
93 South Beach, Chatham	36	40	30	40	AM, CS, LS, MJ
94 Tern Island, Chatham	1	2 <sup>m</sup>	2	2 <sup>m</sup>	LS
95 Nauset Beach, Chatham	8	8	13	8	KCo, ME
96 Nauset Beach, Orleans	6	7	10	7	KCo, ME
97 Nauset Spit (Heights), Orleans	15	15	7	15	KCo, ME
98 New Island, Orleans	0	0	0	0	EH, SM
99 Skaket Beach, Orleans	0	nd	nd	nd	SM
100 Rock Creek (north side), Orleans	0	nd	nd	nd	SM
101 First Encounter Beach, Eastham	0	nd	nd	nd	SM
102 Coast Guard Beach, Eastham	10	13	22	13	EH, KD
103 Marconi Beach/LeCount Hollow, Wellfleet	12	12	13	12	EH, KD
104 Sunken Meadow Spit, Wellfleet	1	1	3	1	JB
105 Lieutenant's Island, Wellfleet	0	1	2	1	HG, JB
106 Indian Neck, Wellfleet	0	nd	nd	nd	SM
107 Jeremy Point/Great Island, Wellfleet	9	9	26	9	EH, KD

Table 1. Continued

Location	Number of pairs		No. chicks fledged	No. pairs for which fledge data reported	Source
	Index count	Total count			
108 Pamet Harbor-South, Truro <sup>n</sup>	0	0	0	0	EH, SM
09 Pamet Harbor-North/ Corn Hill Beach, Truro	2	2	7	2	
10 Pond Village Beach, Truro	0	0	0	0	HG
11 Pilgrim Beach/Beach Point, Truro	2	2	4	2	HG
12 Ballston Beach/Newcomb Hollow, Truro	3	3	3	3	HG
13 Longnook Beach, Truro	0	0	0	0	EH
14 Highland Beach, Truro	1	1	4	1	EH
15 High Head/Head of the Meadow, Truro	3	3 <sup>o</sup>	0	3 <sup>o</sup>	EH
16 Race Point-South Beach, Provincetown/Truro <sup>p</sup>	13	14 <sup>o</sup>	31	14 <sup>o</sup>	EH
17 Race Point-North Beach, Provincetown	3	3 <sup>q</sup>	0	3 <sup>q</sup>	EH
18 Long Point/Wood End, Provincetown	5	6 <sup>q</sup>	12	6 <sup>q</sup>	EH
<b>BRISTOL COUNTY</b>					
119 Stony Point Dike, Wareham	2	2	3	2	MZ
120 Long Beach Point, Wareham	nd	nd	nd	nd	
21 Little Harbor Beach, Wareham	nd	nd	nd	nd	-
22 Strawberry Point, Mattapoisett	1	1	0	1	JHa
23 West Island, Fairhaven	2 <sup>r</sup>	2 <sup>r</sup>	2	2 <sup>r</sup>	
24 Winsegansett Heights, Fairhaven	0	0	0	0	SGO, JHi, NL, ES
25 Round Hill Beach, Dartmouth	0	0	0	0	SGO, JHi, NL, ES
26 Salters Pond, Dartmouth	2	2	2	2	SGO, JHi, NL, ES
27 Demarest-Lloyd State Park, Dartmouth	0	0	0	0	SGO, JHi, NL, ES
28 Little Beach/Barney's Joy, Dartmouth	10	11	14	11	SGO, JHi, NL, ES
29 Gooseberry Neck, Westport	0	0	0	0	SGO, JHi, NL, ES
30 Horseneck Beach, Westport	13	15	27	15	SGO, JHi, NL, ES
31 Acoaxet, Westport	0	0	0	0	SGO, JHi, NL, ES



Table 1. Continued.

Location	<u>Number of pairs</u>		No. chicks fledged	No. pairs for which fledge data reported	Source
	Index count	Total count			
Cockeast Pond, Westport	1	1	0	1	SGO, JHi, NL, ES
Richmond Pond, Westport	1	2 <sup>s</sup>	4	2 <sup>s</sup>	SGO, JHi, NL, ES
Bay Point, Swansea	nd	nd	nd	nd	-
<b>ELIZABETH ISLANDS</b>					
Naushon Island	nd	0	nd	nd	JHa
Pasque Island-Robinson's Hole	3	3	nd	nd	JHa
Pasque Island-Cobbly	nd	0	nd	nd	JHa
Pasque Island-Quicks Hole	nd	0 <sup>t</sup>	nd	nd	JHa
Nashawena Island-Quick's Hole	4	4	0	4	LR
Nashawena Island-Canapitsit	0	0	0	0	JM, LR
Cuttyhunk Island	4	4	nd	nd	SM
Penikese Island	0	0	0	0	BB, JL
<b>MARTHA'S VINEYARD</b>					
Harthaven, Oak Bluffs	0	1 <sup>u</sup>	0	1 <sup>u</sup>	DS
Sylvia State Beach, Edgartown	4	4	7	4	KC, RC, SJ
Cow Bay, Edgartown	nd	nd	nd	nd	-
Eel Pond/Little Beach, Edgartown	2	3 <sup>v</sup>	3	3 <sup>v</sup>	DS
Lighthouse Beach, Edgartown	0	1 <sup>v</sup>	0	1 <sup>v</sup>	DS
Chappaquiddick Beach, Chappaquiddick	0	0	0	0	DS, BC, WM
Cape Pogue Elbow/The Narrows, Chappaquiddick	4	4	0	4	WB, LR
Arruda's Pt./The Jetties, Chappaquiddick	0	0	0	0	WB, LR
Leland/East Beaches, Chappaquiddick	0	0	0	0	WB, LR
Wasque, Chappaquiddick	1	1	3	1	WB, LR

Table 1. Continued.

Location	Number of pairs Index count	Total count	No. chicks fledged	No. pairs for which fledge data reported	Source
153 Norton Point Beach, Edgartown	7	8 <sup>u</sup>	1	8 <sup>u</sup>	KC, MV, RC
51 South Beach, Edgartown	nd	nd	nd	nd	-
64 Edgartown Great Pond/Job's Neck, Edgartown <sup>x</sup>	2	3	1	3	DS
2 Oyster and Watcha Ponds, Edgartown and W. Tisbury	0	0	0	0	DS
7 Tisbury Great Pond/Black Point Pond/ Quansoo/Long Point, Chilmark <sup>y</sup>	9 <sup>z</sup>	10 <sup>z</sup>	17	10 <sup>z</sup>	DS, LR
7 Chilmark Pond, Chilmark	1	2	3	2	DS, BC, WM
4 Lucy Vincent Beach, Chilmark	1	1	1	1	RC
1 Long Beach/Squibnocket Beach, Chilmark	6	6	4	6	DS
1 Moshup Trail Beach, Gay Head	1	1	1	1	DS
62 Dogfish Bar, Gay Head	4	4	2	4	DS
63 Lobsterville Beach, Gay Head	1	1	0	1	LTD
64 Cedar Tree Neck/Lambert's Cove, West Tisbury	nd	nd	nd	nd	-
66 Great Rock Bight Preserve	0	0	0	0	BC, WM
2 Sepiessa Point Reservation	0	0 <sup>aa</sup>	0	0	BC, WM
30 Tashmoo, Tisbury	1	1	3	1	DS
1 Wilfred's Pd. and Mink Meadows Beach, Vineyard Haven	1	1	1	1	DS, BC, WM
10 Nomans Land	nd	nd	nd	nd	-
<b>NANTUCKET</b>					
40 Great Point	3	3 <sup>bb</sup>	4	3 <sup>bb</sup>	LR, ER
11 The Galls	1	2 <sup>bb</sup>	0	2 <sup>bb</sup>	LR, ER
72 Coskata-West Beach <sup>cc</sup>	1	1	0	1	LR, ER

Table 1. Continued.

Location	<u>Number of pairs</u>		No. chicks fledged	No. pairs for which fledge data reported	Source
	<u>Index count</u>	<u>Total count</u>			
127 Coskata-Inner Trail <sup>dd</sup>	0	0	0	0	LR, ER
Coatue	1	1	2	1	KCB, JL
26 Coskata-East Beach	1	1	0	1	LR, ER
26 Coskata Inlet/The Haulover	0	2 <sup>ee</sup>	0	2 <sup>ee</sup>	KCB
Wauwinet	1	1	0	1	SP
27 Squam Pond	2	2	6	2	KCB, AR, DC
Quidnet/Sesachacha Pond	0	0	0	0	DC
27 Low Beach/Tom Nevers <sup>ff</sup>	8	8	15	8	LM, TS
Surfside	nd	nd	nd	nd	-
Hummock Pond	1	1	3	1	KCB, CW
27 Smith Point	16	16	44	16	VT, TS
27 Eel Point	3	4	9	4	KCB, CW
Dionis Beach	0	0	0	0	VT, TS
27 Quaise Point	0	nd	nd	nd	LM, VT
27 Tuckernuck Island	2	2	nd	nd	LM
187 Muskeget Island	7	7	nd	nd	VT
<b>TOTALS</b>	<u>475</u>	<u>495</u>	<u>705</u>	<u>471</u>	

<sup>a</sup> Index count = number of territorial pairs counted between May 30 and June 7, 1998, the standardized index count period for the Atlantic Coast population.

<sup>b</sup> Total count = total number of territorial pairs present during all or a portion of the breeding season. Pairs that are suspected of nesting at more than 1 site are only tallied once in

regional and state totals and total numbers of pairs for which fledging data were reported.

<sup>c</sup> Chicks fledged are defined as chicks  $\geq$  25 days of age or observed in flight, whichever occurs first.

<sup>d</sup> Key to sources: AG = Andrea Goldstein, AMa = Angeline May, AMc = Ashley McRae, AR = Allen Reinhard, BB = Brad Blodget, BC = Beth Crosby, BZ = Brad Zitske, CN = Christine Nelson, CS = Caleb Spiegel, CW = Chuck Weikert, DC = Dan Chace, DM = Deborah Melvin, DS = Debra Swanson, EH = Ed Hoopes, ES = Ellen Steiner, GV = Griff Venator, HG = Heather Gamper, HS = Helen Stevens, JB = Judy Brainerd, JC = J. Cohen, JHa = Jeremy Hatch, JHi = John Hill, JL = Jennifer Lavin, JLi = Jerome Light, JLv = Jean Livingston, JLy = Justine Lynch, JM = Jamie McCullen, JT = Jeff Trapani, KC = Kate Conde, KCo = Kerry Collier, KCB = Karen Combs-Beattie, KCr = Kim Crawford, KD = Kerri Davis, KN = Kathy Napierkowski, LG = Laura Gill, LM = Larry Miller, LR = Lloyd Raleigh, LS = Lisa Strock, LT = Leslie Thurston, LTD = Leah Tofte-Dorr, MBa = Matt Bailey, MBl = Mike Blondin, MC = Marc Carullo, ME = Megan Eldredge, MF = Matt Franchina, MJ = Martha Jason, MZ = Margo Zdravkovic, NL = Nicole LeBlanc, PD = Pam Denmon, RC = Ryan Chandler, RCu = Robert Culbert, RH = Ruth Hefty, RS = Richard Sousa, RV = Robert VanderPyl, SG = Sara Gathers, SGO = Sasha Gay-Overstreet, SH = Scott Hecker, SJ = Susan Jones, SKe = Shannon Keane, Sko = Stephanie Koch, SM = Scott Melvin, SO = Stephanie Owens, TE = T. Elsey, TK = Ted Kraska, TS = Tracy Sundell, VT = Vincent Todd, WB = Wendy Breiby, WC = Wayne Castonguay, WM = Wendy Malpass.

<sup>e</sup> nd = no data available

<sup>f</sup> It is likely that the pair at Plum Island-North End that abandoned its nest on June 1 renested elsewhere on the North Shore. This pair is reported for the site, but is not included in regional or state total counts and counts of pairs with fledge data.

<sup>g</sup> We suspect that pair #7 that lost its nest at Parker River NWR on June 2 renested at Sandy Point State Reservation on June 22. This pair is tallied in totals for both sites, but only once in total counts and numbers of pairs with fledge data for the region and state.

<sup>h</sup> We suspect that at least one of the pairs at Crane Beach (pair #34, discovered with a brood of 1-2 day-old chicks on July 22) may have nested previously at another site. This pair is included in total count and number of pairs with fledge data for Crane Beach, but not in regional or state totals.

<sup>i</sup> A pair was scraping at Fourth Cliff during the index count period, but did not nest there and

moved back and forth between Third and Fourth Cliff. We believe this pair eventually nested at Third Cliff (probably nest 1B). This pair is reported for both sites, but tallied only once in regional and state index and total counts and numbers of pairs with fledge data.

<sup>j</sup> We suspect that at least 2 of the 15 pairs reported from Plymouth Beach were the result of double-counting, ie. were probably renests by pairs that had already been counted. We believe that 13 pairs is likely a more accurate index and total count for Plymouth Beach in 1998.

<sup>k</sup> We suspect that pair # 2 reported at New Seabury (nest found with 3 eggs on June 25) probably had already nested elsewhere on the Upper Cape. This pair is included in totals for the site, but not in regional or state total counts or pairs with fledge data.

<sup>l</sup> The third pair reported at Long Beach was last seen on May 26 and no nest was found. We suspect it moved to another beach. This pair is included in totals for the site, but not in regional or state total counts or pairs with fledge data.

<sup>m</sup> We suspect that pair #2 on Tern Island (present from June 18 through July 7, with nest scrapes, territorial defense, and false brooding, but no nest found) had nested elsewhere on the Outer Cape before moving to Tern Island. This pair is included in totals for the site, but not in regional or state total counts and numbers of pairs with fledge data.

<sup>n</sup> Pamet Harbor-South is the beach at the south entrance to Pamet Harbor.

<sup>o</sup> Pair #4 at High Head (nest lost to overwash on June 14) is suspected to have renested at Race Point South (3-egg clutch found on June 24). This pair is included in tallies for both sites, but only once in regional and state tallies for total count and number of pairs with fledge data.

<sup>p</sup> Race Point-South Beach includes all the Atlantic Ocean-facing beaches of Cape Cod National Seashore from High Head north to the beginning of Race Point Beach proper, including locations referenced in previous years as Mission Bell, Frenchie's, Exit 9, and Armstrong Cut.

<sup>q</sup> We suspect that pair #1 at Race Point North (lost nest RPN 5 on May 24) moved to Wood End and renested as WE6 (found with 1 egg on June 17). This pair is tallied for both sites, but only once in regional and state total counts and numbers of pairs with fledge data.

<sup>r</sup> We suspect that pair #2 at West Island (lost nest on May 29 and left soon thereafter) likely moved to another beach in Bristol County where they would have been recounted. This pair is included in tallies for West Island, but not in regional or state totals for index or total count or number of pairs with fledge data.

- \* We suspect that pair #1 at Richmond Pond (abandoned nest on May 21, no renest reported) moved elsewhere in Bristol County and renested. This pair is included in tallies for Richmond Pond, but not in regional or state tallies for total count or number of pairs with fledge data.
- † A single piping plover was present at Quick's Hole Beach on Pasque Island when visited by J. Hatch on June 28.
- " The pair at Harthaven disappeared soon after losing chicks < 24 h after hatching on May 24. We suspect this pair probably moved to another site and was counted there also. This pair is included in site tallies for total count and pairs with fledge data, but not in regional or state totals
- √ We suspect that one of the pairs at Little Beach moved there from Lighthouse Beach after losing their nest to predators May 28-29. This pair is tallied in total counts and pairs with fledge data for both sites, but only once in regional and state totals.
- " An eighth pair was observed at the Wasque end of Norton Point in April and until mid to late May. It was not present after late May, and no nest was found. We assume this pair likely moved and was counted at a second site as well. This pair is included in total count and pairs with fledge data for Norton Point, but not in regional or state totals.
- \* The Edgartown-Great Pond site includes the beach in front of Crackatuxet Pond.
- √ This site also includes the Lewis property and Long Point Wildlife Refuge.
- ² We suspect that pair no. 2 at Black Point Pond( lost nest 2A on 23-24 April) likely renested somewhere along the stretch of beach from Black Point Pond east to Long Point. To avoid double-counting, this pair is not included in index count, total count, or number of pairs with fledge data for this site or in state totals.
- ab Although no nesting Piping Plovers were documented at Sepiesssa Point Reservation in 1998, 6 adults were observed feeding along the pond shore on July 7.
- bb We suspect that pair no. 3 at The Galls (nest 1, abandoned on 27 May) renested at Great Point where it was recorded as pair no. 7 or 8. This pair is included in total counts and numbers of pairs with fledge data for both The Galls and Great Point, but omitted from regional and state totals.

<sup>cc</sup> Coskata-West Beach refers to the beach along the Nantucket Sound side of Coskata, from the south end of The Galls south and west to the boundary of Coatue. This is the same area that was referenced as Coskata-North Beach by Tina Whitman in 1993 and was included as part of The Galls by Marcia Litchfield in 1991 and 1992. Census data for Great Point, The Galls, and Coskata-West Beach were not reported separately in 1996 or 1997.

<sup>dd</sup> Coskata-Inner Trail refers to the inland trail running south and west from Coskata toward Coatue. Coskata-East Beach refers to the beach along the eastern (Atlantic) side of Coskata, including the washover at The Glades. Coskata Inlet is the inlet from Nantucket Harbor into Coskata Pond.

<sup>ee</sup> Both pairs at the Haulover lost their nests (approximately 26 and 29 May) and left the area immediately. We suspect they moved to other sites on Nantucket and were tallied there as well. To avoid double-counting, these pairs are included in total counts and numbers of pairs with fledge data for the Haulover site, but not in regional or state totals.

<sup>ff</sup> Low Beach/Tom Nevers includes entire beach from Siasconset south and west to abandoned Navy base southwest of Tom Nevers Head.

Table 2. Summary of abundance and productivity of Piping Plovers in Massachusetts, 1985-1998.

Year	Index count <sup>a</sup>	Total count <sup>b</sup>	Mean chicks fledged/pair	Pairs with fledge data
1998	475	495	1.50	471 (95)
1997	457	483	1.33	468 (97)
1996	437	454	1.35	441 (97)
1995	413	441	1.62	426 (97)
1994	329	352	1.80	334 (95)
1993	258	289	1.92	264 (91)
1992	207	213	2.03	206 (97)
1991	148	160	1.72	156 (98)
1990	111	140	1.38	125 (89)
1989	-	137	1.59	123 (90)
1988	-	134	1.29	114 (85)
1987	-	126	1.07	89 (71)
1986	-	139	-	-
1985	-	131	-	-

<sup>a</sup> Index count = total territorial pairs counted during 9-day standardized count period in late May and/or early June.

<sup>b</sup> Total count = total number of territorial pairs present during all or a portion of the breeding season.



Table 3. Summary of Piping Plover abundance (total pairs) and productivity (mean number of chicks fledged per pair) by region of Massachusetts, 1996 - 1998.

Region	Total pairs			Mean chicks fledged/pair		
	1996	1997	1998	1996	1997	1998
North Shore	55	47	56	0.96	1.83	1.64
South Shore	26	31	36	2.04	1.71	1.50
Upper Cape	68	92	94	2.49	1.49	1.91
Lower Cape	162	172	167	1.18	1.26	1.28
Bristol County	31	36	34	1.35	1.47	1.53
Elizabeth Islands	9	14	11	0.86	0.00	0.00
Martha's Vineyard	59	54	49	1.12	0.92	0.96
Nantucket, Tuckernuck, and Muskeget Islands	44	36	48	0.68	0.84	2.13
Total	454	483	495	1.35	1.33	1.50

Table 4. Reported causes of Piping Plover nest failures (n = 265) in Massachusetts, 1998.

Cause of nest failure	Number of nests		Total
	With exclosure	Without exclosure	
Abandonment	51	30	81
Overwash/flooding	29	30	59
Unknown predator	6	38	44
Crow	1	23	24
Fox	5	6	11
Skunk	4	4	8
Gull	0	6	6
Coyote	0	2	2
Eggs failed to hatch	4 <sup>a</sup>	0	4
Off-road vehicle	0	1	1
Other <sup>b</sup>	2	5	7
Unknown	1	17	18
Total	103	162	265

<sup>a</sup> Two nests on Nantucket may have failed to hatch because of human disturbance. Nests at The Galls and on Coskata-West Beach failed to hatch after 49 and 45 days of incubation, respectively. One was located  $\leq 20$  feet, the other only 5-10 feet, inside symbolic fencing next to heavily used off-road vehicle areas.

<sup>b</sup> "Other" causes of nest failure included 1 exclosed nest lost to skunk or fox, 1 exclosed nest lost to skunk or rat, 1 exclosed nest suspected lost to rat, 2 exclosed nests lost to an unidentified avian predator that entered through twine tops, 1 unexclosed nest stepped on by a white-tailed deer, and 1 unexclosed nest from which 2 eggs were depredated by an unidentified predator and that was subsequently abandoned after exclosure installation.

Table 5. Suspected causes of Piping Plover nest abandonments (n = 81) in Massachusetts, 1998.

Cause of nest abandonment	Number of nests		Total
	With exclosure	Without exclosure	
Unknown	32	20	52
Severe inclement weather <sup>a</sup>	8	9	17
Fox harassment	5	0	5
Crow harassment	2	0	2
Skunk harassment	1	0	1
Cat harassment	1	0	1
Human disturbance	1	0	1
Adult depredated	2	0	2
Total	52	29	81

<sup>a</sup> Includes strong winds and, in some instances, heavy rain.

Table 6. Comparison of Piping Plover nest success in Massachusetts, 1998, with and without predator exclosures.

Fate of nests	Number of nests (%) <sup>a</sup>	
	With exclosure	Without exclosure
Successful <sup>b</sup>	270 (78)	78 (38)
Unsuccessful	77 (22)	129 (62)
Total	347 (100)	207 (100)

<sup>a</sup> Not included in this table are 59 nests lost to flooding (29 exclosed, 30 unexclosed).

<sup>b</sup> Nests were considered successful if they hatched  $\geq 1$  egg.

Table 7. Comparison of Piping Plover hatching success in Massachusetts, 1998, with and without predator exclosures.

Fate of eggs	Number of eggs (%) <sup>a</sup>	
	With exclosure	Without exclosure
Hatched	957 (72)	230 (38)
Depredated/ failed	364 (28)	381 (62)
Total	1,321 (100)	611 (100)

<sup>a</sup> Not included in this table are 112 eggs in exclosures and 73 eggs without exclosures that were lost to high tide overwash or flooding from heavy rains.